this motion is that the three double bonds travel round the ring, whilst a labile form of the molecule with six free valencies is also indicated. In this way many of the peculiar properties of aromatic compounds may be accounted for.

THE additions to the Zoological Society's Gardens during the past week include a Sooty Mangabey (*Cercocebus fuliginosus*) from West Africa, presented by Mr. C. J. Spencer; a Levaillant's Cynictis (*Cynictis penicillata*) from South Africa, presented by Miss Bald; a Blue and Yellow Macaw (*Ara chloroptera*), a Red and Yellow Macaw (*Ara ararauna*) from South America, presented by General Sir Frederick Forestier Walker, K.C.B., G.C.M.G.; two Wharton's Fruit Pigeons (*Carpophaga whartoni*), a Christmas Island Dove (*Chalcophaps natalis*), five Christmas Island Crabs (*Birgus latro*) from Christmas Island, presented by Captain A. W. Cole; a Chameleon (*Chamaeleon vulgaris*) from North Africa, presented by Mrs. T. Wallis; seven Spiny-tailed Mastigures (*Uromastix acanthinurus*) from North Africa, three Brazilian Amphisbœnas (*Amphisboena brasiliana*) from Brazil, an Indian Eryx (*Eryx johni*) from India, two Sharp-nosed Snakes (*Lioheterodon madagascariensis*) from Madagascar, deposited; six Black Swans (*Cygnus atratus*) bred in the Gardens.

OUR ASTRONOMICAL COLUMN.

THE FORMATION OF THE POLAR CAPS ON MARS.—An interesting paper, by Mr. Percival Lowell, which deals with the manner of formation of the Martian polar caps is published in No. 2 of the Lowell Observatory *Bulletins*. Mr. Lowell observed the old polar cap on July 3, and found it to be diminishing; on July 5 it was only $29''$ of arc in diameter, equal to a diameter of 4°.1 on the planet's surface; and shortly afterwards he noticed that a new, large, white deposit had formed, north of Arethusa Lacus and touching the Pierius-Callirrhoe, in longitude 340°. This new white patch extended from the old polar cap to about latitude 55° N., and the Pierius, which it crossed, could be seen running through it, thereby showing that the appearance was due to a deposit and not to clouds, which would have obliterated all the features equally; it also indicates that some kind of vegetation, which had caused the deposit partially to melt, exists in the neighbourhood of the Pierius.

From July 7 to 17 the dark line of demarcation which usually surrounds the cap became less marked, until it was finally obliterated by the encroaching deposit of frost, only a superior whiteness, caused by the newly deposited frost lacking the sheen of the older, weathered and ice-welded snow, marking the presence of the older cap. It is only reasonable to suppose that this deposit actually was frost as we know it, for it is evident that a layer of frozen gas, such as solid carbon dioxide, would pass directly from the solid to the gaseous form under the pressure conditions obtaining on Mars, and would not exhibit the phenomenon of slowly melting such as was observed in the region about the Pierius.

The quick melting of the outer and the durability of the inner portion of the Martian snow-cap are both explained by these observations, which show that the whole cap consists of a perpetual kernel which periodically becomes surrounded by a shallow transitory husk, the formation of which was observed by Mr. Lowell.

The same observer also performed some experiments in connection with the visibility of the Martian canals, which showed that a wire having an angular width of $0''.69$ at 1800 yards could be readily "glimpsed" with the naked eye, and from this he deduces that any canal having a width of half a mile on the planet's surface should be readily observable with a good telescope.

WOLF'S VARIABLE STAR 59, 1903, CYGNI.—A communication from Prof. Pickering to the *Astronomische Nachrichten* (No. 3911) states that the star recently announced by Wolf as being a probable nova appears on a large number of plates taken at Harvard between October 29, 1891, and the present time. On a plate exposed on July 30, 1895, the spectrum of this star is of the fourth type, and, from the series of plates, it is seen that the brightness varies by more than two magnitudes.

In the same periodical Prof. Wirtz records an observation made by him at Strassburg on October 15, when he found that the approximate magnitude of this object was 10·5, and that a comparison of its focus with that of several known stars on the Strassburg refractor showed no difference. The identity of this variable with the star B.D. + 37°.3876 is confirmed by Prof. Wirtz.

PERIODICAL CHANGES IN THE COLOURS OF JUPITER'S BELTS.—In No. 3908 of the *Astronomische Nachrichten*, Mr. Stanley Williams directs attention to the periodical colour changes of Jupiter's equatorial belts announced in vol. lix. (p. 378) of the *Monthly Notices*.

The computed times of the maximum and minimum brightness of the respective belts are very uncertain, and Mr. Williams suggests that careful observations should be immediately commenced with the object of exactly determining the date when the red colour has entirely disappeared from the southern belt, and also the date of its corresponding reappearance, which will probably take place some time next year.

Mr. Williams's own observations indicate that the red colour has already almost entirely disappeared from this belt, some parts actually appearing blue, except in the neighbourhood immediately following the Great Red Spot, between longitudes 60 and 180, whilst the northern belt is of a bright, deep red colour.

THE MULTIPLE TAIL OF COMET 1903 *c*.—In discussing a number of beautiful photographs of Borelly's comet, which were obtained at Yerkes with a lantern lens having an aperture of 1·6 inches and a focal length of 6·3 inches, and are reproduced in the current number of the *Astrophysical Journal*, Prof. Barnard advances a novel explanation of the great changes of form which were observed in the tails of this and other comets.

From two photographs taken at Yerkes on July 24, the one immediately after the other, and one taken by M. Quénisset at Nanterre on the same date, it is seen that an enormous change in the form of the tail took place at about 2h. 30m. (G.M.T.), when a section of it broke away from the head and travelled in a retrograde direction at a rate, referred to the motion of the head, of about 29 miles per second. As the velocity of the comet itself was, at this period, about 22 miles per second *towards* the sun, it will be seen that the actual velocity of the section showed a repulsion of 7 miles per second *from* that body.

As an explanation of this phenomenon, Prof. Barnard suggests that either the outburst from the coma suddenly took place in a slightly different direction, or else the existing tail was forcibly detached by some unknown body (*e.g.* a swarm of meteorites), and simply floated away in its old path, under the sun's repulsion, until it was dissipated, or its light-emitting power died away; meanwhile, the new tail was formed by the material evolved by the coma, and for some reason the particles were evolved with a greater velocity than before, so that we get the phenomenon of the two tails nearly parallel for some distance, as shown on the Yerkes and other photographs.

THE SWISS ASSOCIATION OF NATURAL SCIENCES.

THE eighty-sixth meeting of the Société helvétique des Sciences naturelles was held at Locarno on September 2–5. Both as regards the number of visitors and the number and variety of the papers read, the gathering was highly successful. Several of the communications presented at the general meetings of the Association were especially well received.

M. A. Pioda (Locarno), the president for the year, after referring to the naturalists of the nineteenth century in his presidential address, went on to show that, in the same way as all other sciences have gradually been differentiated from

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metaphysics, it was now the case with psychology. He spoke of the importance of this process as far as the increase of knowledge is concerned, and also as regards the improvement of each of the sciences and their relations one to another. He then traced the experimental and speculative character of psychology. Experimental psychology, the president urged, should confine itself solely to the scientific observation of facts. Certain facts, called psychical (Wallace, Crookes, Zöllner, Thury, &c.), are incapable of any explanation, at least by known physical forces, and it is the duty of science to examine these if psychology is really to assume an experimental character. The facts referred to belong, it may be, to psychophysics. When psychology has really become an experimental science such phenomena will be known not only by their external manifestations, but also by their hidden source, and the knowledge of them will become an organic whole.

Mr. E. Fischer (Bern) read a paper on the biological species of parasitic fungi and of the origin of new forms in the vegetable kingdom. The nature and properties of biological species were studied particularly in the Uredinées, and more recently in *Claviceps purpurea*. Philogenetically, at present, a common origin is attributed to the biological forms of a *species*; consequently, it seems plausible that the original form (Stammform) inhabits all the hosts on which its descendants now live, and that some at least among its descendants may be specialised on one or other of the nourishing plants. Reciprocally, the passage of one parasite to new hosts has been observed directly. Among the causes of the origin of biological species, following Klebalen, is admitted in the first line the direct adaptation (Anpassung und Angewöhnung) of these nourishing plants. It was also said that the explanation given is not applicable at present to the origin of species morphologically different; the morphological characters of species are, at most, partially attributable to the direct action of the nourishing plants (Näherpflanzen), and for the most part they must be related to the characters of the organisation in the sense used by Nägeli.

M. H. Dufour (Lausanne) took for the subject of his paper to the conference ten years' observations of solar radiation in Switzerland, and its diminution in 1903. The Swiss plateau on the north of the Alps (Lausanne, Bern, Zürich, Bâle) has a number of hours of sunshine varying between 1900 at Lausanne and 1200 at Bâle, that is to say, 47–44 per cent. of the greatest insolation possible. The maximum occurs in August (64–57 per cent.), the minimum in December or January (27–29 per cent.); in March and May the insolation is relatively feeble. To the south of the Alps (Lugano, Locarno) 2300 hours of sunshine were recorded, 59 per cent. of the possible maximum; two minima occur in May and November, and two maxima in July and February, with 60 per cent. At Alpine observatories the character of the results changes. At Davos (1500 m.) the insolation is not so strong in winter as in summer, when 1800 hours of sunshine are recorded; two minima are observed—in January and May—and two maxima (February and September–October). At the summit of Säntis (2500 m.) the insolation of winter, 45 per cent., exceeds markedly that of summer, 40 per cent. The mean amount is 42 per cent; the minimum occurs in May and June, and the maximum in November. For the intensity of the solar radiation, measured by Bührer (Clarens-Montreux) and Dufour (Lausanne), the result has been obtained of 8·5 calories (kilogram-degrees) per minute and per square metre of normal black surface on the sun between 11 and 1 o'clock. The maximum occurs in April–May, the minimum in January. At an altitude of 400–500 m. it rarely exceeds 10 calories, at 2000 m. (Rochers de Naye) 13 calories. In 1903 the values of the actinometric measures are notably feebler than in previous years, probably because of an abnormal opacity of the atmosphere, which may be attributed to the diffusion in the air of dust arising from the violent volcanic eruptions of the Lesser Antilles, which would facilitate the condensation of aqueous vapour in the form of fog—very attenuated and invisible, but yet absorbent.

M. P. Weiss (Zürich) exhibited by means of a series of interesting experiments the new magnetic properties of pyrrhotine, that is to say, the directions in which crystals of this mineral are sensitive to the influence of magnets.

M. A. Lang (Zürich), in speaking of the biological significance of elegance in certain marine organisms, said that the scientific study of animal forms did not prevent an understanding of the æsthetic manifestations of nature which could be applied in decorative art, for instance. He showed that all those characters which give beauty and charm to the marine fauna—such as form and symmetry, phosphorescence, and transparency—enable these animal forms to respond to their environment, and thus to facilitate and assure their continued existence.

The number and importance of the communications which dealt with the canton of Ticino were very remarkable. M. C. Keller (Zürich), with his descent of the animal world of the Ticino cantons showed that the fauna principally studied by Stabile and Pavesi contains very different elements; the lacustrine is a *fauna relicta* (Pavesi), and the terrestrial contains arctico-alpine elements. But the most remarkable characteristics are those of the sylvatic fauna of central Europe, and also the great number of types of the Mediterranean subregion. He also made several interesting comparisons with the fauna of other Swiss regions, and showed several new researches for Ticino which have been found by him. At the same meeting M. F. Merz (Bellinzona) spoke on the forestry of the Ticino canton, and similar questions were referred to in various sections by MM. Freuler, Bettelini, Calloni, and Pometta.

The most largely attended sectional meetings were those concerned with physics and chemistry, and the most important papers read at these meetings were those of MM. Haller (Paris), Schär (Strassburg), de la Rive (Geneva), Nölting (Mülhouse), Forel (Morges), Bertoni (Livorno), Tomasina, Soret (Geneva), Schühmacher-Kopp (Lucerne), Riggenbach (Bâle), Hagenbach (Bonn), and others.

In the botanical section the most interesting communications were those of MM. Rikli (Zürich), C. Schröter (Zürich), A. Usteri, and Wilezeck (Lausanne); in the zoological section a magnificent monograph was presented by the honorary member, M. P. Pavesi (Pavia), on the fauna of the valley of Aosta, and papers were read by MM. Lang, Keller, Studer (Bern), Volz (Bern), and Pictet (Geneva); the section of geology and mineralogy mustered but a very small attendance, for the Swiss geologists were almost all at the international congress at Vienna.[1]

The excursions and the receptions, which took place in exceptionally fine weather, the cordial welcome and generous hospitality of the residents, all contributed to the splendid success of this year's gathering.

R. NATOLI.

THE NATURE-STUDY EXHIBITION.

THROUGH the kindness of the Civil Service Commissioners and His Majesty's Office of Works a Nature-Study Exhibition was held at Burlington Gardens from October 30 to November 3. In the absence of Lord Avebury, chairman of the committee, Sir Henry Howarth presided, and Sir John Cockburn declared the exhibition open.

It may at once be said that the object of the undertaking was to put into effect, forthwith, the lessons learned from the exhibition held last year at the Royal Botanic Gardens. There, through the energy of Mr. J. C. Medd, for the first time were brought together all the various methods and matters which have been taken or mistaken for nature-study. It soon became obvious that much excellent science teaching on the one hand was masquerading under the title, and on the other that desultory collecting without rhyme or reason was a second claimant for it.

At the suggestion of Mr. Wilfred Mark Webb, honorary secretary of the Middlesex Field Club and Nature-Study Society, delegates from it and from the Selborne Society met to appoint a committee to organise an exhibition on definite lines. The area from which exhibits were invited was also restricted to a dozen or so counties within easy reach of London. Evidence of work was asked for which dealt with such observational teaching as should form part of the education of all. This, while serving as an excellent preparation for science, is scientific only as regards method and accuracy of treatment.

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[1] The communications to the various meetings of which mention is made will appear in the *Actes* and the *Comptes rendus* of the Association, most of them *in extenso*. Thanks are due to MM. Pioda, Fischer, Keller and Dufour for information very readily given.

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